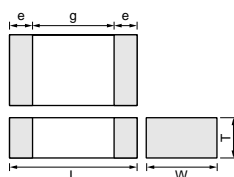


Monolithic Ceramic Capacitors GR_R6/R7/F5/E4 (X5R/X7R/Y5V/Z5U)

High Dielectric Constant Type 6.3/16/25/50V



Part Number	Dimensions (mm)				
	L	W	T	e	g min.
GRM155	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.3	0.4
GRM188*	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.5
GRM216	2.0 ±0.1	1.25 ±0.1	0.6 ±0.1	0.2 to 0.7	0.7
GRM219			0.85 ±0.1		
GRM21A			1.0 ±0/-0.2		
GRM21B			1.25 ±0.1		
GRM316	3.2 ±0.15	1.6 ±0.15	0.6 ±0.1	0.3 to 0.8	1.5
GRM319			0.85 ±0.1		
GRM31M			1.15 ±0.1		
GRM31C			1.6 ±0.2		

* Bulk Case : 1.6 ±0.07(L)×0.8 ±0.07(W)×0.8 ±0.07(T)

Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM033R61A152KA01	X5R (EIA)	10	1500pF ±10%	0.6	0.3	0.3
GRM033R61A222KA01	X5R (EIA)	10	2200pF ±10%	0.6	0.3	0.3
GRM033R61A332KA01	X5R (EIA)	10	3300pF ±10%	0.6	0.3	0.3
GRM033R61A472KA01	X5R (EIA)	10	4700pF ±10%	0.6	0.3	0.3
GRM033R61A682KA01	X5R (EIA)	10	6800pF ±10%	0.6	0.3	0.3
GRM033R61A103KA01	X5R (EIA)	10	10000pF ±10%	0.6	0.3	0.3
GRM155R61C104KA88	X5R (EIA)	16	0.10μF ±10%	1.00	0.50	0.50
GRM155R61A683KA01	X5R (EIA)	10	68000pF ±10%	1.00	0.50	0.50
GRM155R61A104KA01	X5R (EIA)	10	0.10μF ±10%	1.00	0.50	0.50
GRM188R61E224KA88	X5R (EIA)	25	0.22μF ±10%	1.60	0.80	0.80
GRM188R61A334KA61	X5R (EIA)	10	0.33μF ±10%	1.60	0.80	0.80
GRM188R61A474KA61	X5R (EIA)	10	0.47μF ±10%	1.60	0.80	0.80
GRM188R61A684KA61	X5R (EIA)	10	0.68μF ±10%	1.60	0.80	0.80
GRM188R61A105KA61	X5R (EIA)	10	1.0μF ±10%	1.60	0.80	0.80
GRM188R60J105KA01	X5R (EIA)	6.3	1.0μF ±10%	1.60	0.80	0.80
GRM219R61A105KC01	X5R (EIA)	10	1.0μF ±10%	2.00	1.25	0.85
GRM219R60J155KC01	X5R (EIA)	6.3	1.5μF ±10%	2.00	1.25	0.85
GRM21BR61A225KA01	X5R (EIA)	10	2.2μF ±10%	2.00	1.25	1.25
GRM21BR60J225KA01	X5R (EIA)	6.3	2.2μF ±10%	2.00	1.25	1.25
GRM21BR60J335KA11	X5R (EIA)	6.3	3.3μF ±10%	2.00	1.25	1.25
GRM21BR60J475KA11	X5R (EIA)	6.3	4.7μF ±10%	2.00	1.25	1.25
GRM319R61A225KC01	X5R (EIA)	10	2.2μF ±10%	3.20	1.60	0.85
GRM31CR61A475KA01	X5R (EIA)	10	4.7μF ±10%	3.20	1.60	1.60
GRM31CR61A106KA01	X5R (EIA)	10	10μF ±10%	3.20	1.60	1.60
GRM31CR60J106KA01	X5R (EIA)	6.3	10μF ±10%	3.20	1.60	1.60
GRM31MR60J475KC11	X5R (EIA)	6.3	4.7μF ±10%	3.20	1.60	1.15
GRM31XR61A335KC12	X5R (EIA)	10	3.3μF ±10%	3.20	1.60	1.30
GRM32ER61A106KC01	X5R (EIA)	10	10μF ±10%	3.20	2.50	2.50
GRM55DR61H106KA88	X5R (EIA)	50	10μF ±10%	5.70	5.00	2.00
GRM033R71C101KD01	X7R (EIA)	16	100pF ±10%	0.6	0.3	0.3
GRM033R71C151KD01	X7R (EIA)	16	150pF ±10%	0.6	0.3	0.3
GRM033R71C221KD01	X7R (EIA)	16	220pF ±10%	0.6	0.3	0.3
GRM033R71C331KD01	X7R (EIA)	16	330pF ±10%	0.6	0.3	0.3
GRM033R71C471KD01	X7R (EIA)	16	470pF ±10%	0.6	0.3	0.3
GRM033R71C681KD01	X7R (EIA)	16	680pF ±10%	0.6	0.3	0.3

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Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM033R71C102KD01	X7R (EIA)	16	1000pF ±10%	0.6	0.3	0.3
GRM033R70J152KA01	X7R (EIA)	6.3	1500pF ±10%	0.6	0.3	0.3
GRM033R70J222KA01	X7R (EIA)	6.3	2200pF ±10%	0.6	0.3	0.3
GRM033R70J332KA01	X7R (EIA)	6.3	3300pF ±10%	0.6	0.3	0.3
GRM033R70J472KA01	X7R (EIA)	6.3	4700pF ±10%	0.6	0.3	0.3
GRM033R70J682KA01	X7R (EIA)	6.3	6800pF ±10%	0.6	0.3	0.3
GRM033R70J103KA01	X7R (EIA)	6.3	10000pF ±10%	0.6	0.3	0.3
GRM155R71H221KA01	X7R (EIA)	50	220pF ±10%	1.00	0.50	0.50
GRM155R71H331KA01	X7R (EIA)	50	330pF ±10%	1.00	0.50	0.50
GRM155R71H471KA01	X7R (EIA)	50	470pF ±10%	1.00	0.50	0.50
GRM155R71H681KA01	X7R (EIA)	50	680pF ±10%	1.00	0.50	0.50
GRM155R71H102KA01	X7R (EIA)	50	1000pF ±10%	1.00	0.50	0.50
GRM155R71H152KA01	X7R (EIA)	50	1500pF ±10%	1.00	0.50	0.50
GRM155R71H222KA01	X7R (EIA)	50	2200pF ±10%	1.00	0.50	0.50
GRM155R71H332KA01	X7R (EIA)	50	3300pF ±10%	1.00	0.50	0.50
GRM155R71H472KA01	X7R (EIA)	50	4700pF ±10%	1.00	0.50	0.50
GRM155R71E682KA01	X7R (EIA)	25	6800pF ±10%	1.00	0.50	0.50
GRM155R71E103KA01	X7R (EIA)	25	10000pF ±10%	1.00	0.50	0.50
GRM155R71E153KA61	X7R (EIA)	25	15000pF ±10%	1.00	0.50	0.50
GRM155R71E223KA61	X7R (EIA)	25	22000pF ±10%	1.00	0.50	0.50
GRM155R71C153KA01	X7R (EIA)	16	15000pF ±10%	1.00	0.50	0.50
GRM155R71C223KA01	X7R (EIA)	16	22000pF ±10%	1.00	0.50	0.50
GRM155R71C104KA88	X7R (EIA)	16	0.10μF ±10%	1.00	0.50	0.50
GRM155R71A333KA01	X7R (EIA)	10	33000pF ±10%	1.00	0.50	0.50
GRM155R71A473KA01	X7R (EIA)	10	47000pF ±10%	1.00	0.50	0.50
GRM155R71A104KA01	X7R (EIA)	10	0.10μF ±10%	1.00	0.50	0.50
GRM188R71H221KA01	X7R (EIA)	50	220pF ±10%	1.60	0.80	0.80
GRM188R71H331KA01	X7R (EIA)	50	330pF ±10%	1.60	0.80	0.80
GRM188R71H471KA01	X7R (EIA)	50	470pF ±10%	1.60	0.80	0.80
GRM188R71H681KA01	X7R (EIA)	50	680pF ±10%	1.60	0.80	0.80
GRM188R71H102KA01	X7R (EIA)	50	1000pF ±10%	1.60	0.80	0.80
GRM188R71H152KA01	X7R (EIA)	50	1500pF ±10%	1.60	0.80	0.80
GRM188R71H222KA01	X7R (EIA)	50	2200pF ±10%	1.60	0.80	0.80
GRM188R71H332KA01	X7R (EIA)	50	3300pF ±10%	1.60	0.80	0.80
GRM188R71H472KA01	X7R (EIA)	50	4700pF ±10%	1.60	0.80	0.80
GRM188R71H682KA01	X7R (EIA)	50	6800pF ±10%	1.60	0.80	0.80
GRM188R71H103KA01	X7R (EIA)	50	10000pF ±10%	1.60	0.80	0.80
GRM188R71H153KA01	X7R (EIA)	50	15000pF ±10%	1.60	0.80	0.80
GRM188R71H223KA01	X7R (EIA)	50	22000pF ±10%	1.60	0.80	0.80
GRM188R71H333KA61	X7R (EIA)	50	33000pF ±10%	1.60	0.80	0.80
GRM188R71H473KA61	X7R (EIA)	50	47000pF ±10%	1.60	0.80	0.80
GRM188R71H683KA93	X7R (EIA)	50	68000pF ±10%	1.60	0.80	0.80
GRM188R71H104KA93	X7R (EIA)	50	0.10μF ±10%	1.60	0.80	0.80
GRM188R71E333KA01	X7R (EIA)	25	33000pF ±10%	1.60	0.80	0.80
GRM188R71E473KA01	X7R (EIA)	25	47000pF ±10%	1.60	0.80	0.80
GRM188R71E683KA01	X7R (EIA)	25	68000pF ±10%	1.60	0.80	0.80
GRM188R71E104KA01	X7R (EIA)	25	0.10μF ±10%	1.60	0.80	0.80
GRM188R71E154KA01	X7R (EIA)	25	0.15μF ±10%	1.60	0.80	0.80
GRM188R71C104KA01	X7R (EIA)	16	0.10μF ±10%	1.60	0.80	0.80
GRM188R71C224KA01	X7R (EIA)	16	0.22μF ±10%	1.60	0.80	0.80
GRM188R71A154KA01	X7R (EIA)	10	0.15μF ±10%	1.60	0.80	0.80
GRM188R71A224KA01	X7R (EIA)	10	0.22μF ±10%	1.60	0.80	0.80
GRM219R71H333KA01	X7R (EIA)	50	33000pF ±10%	2.00	1.25	0.85
GRM219R71H334KA88	X7R (EIA)	50	0.33μF ±10%	2.00	1.25	0.85
GRM219R71E224KC01	X7R (EIA)	25	0.22μF ±10%	2.00	1.25	0.85

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Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM219R71C474KA01	X7R (EIA)	16	0.47μF ±10%	2.00	1.25	0.85
GRM219R71C684KC01	X7R (EIA)	16	0.68μF ±10%	2.00	1.25	0.85
GRM21BR71H473KA01	X7R (EIA)	50	47000pF ±10%	2.00	1.25	1.25
GRM21BR71H683KA01	X7R (EIA)	50	68000pF ±10%	2.00	1.25	1.25
GRM21BR71H104KA01	X7R (EIA)	50	0.10μF ±10%	2.00	1.25	1.25
GRM21BR71H154KA01	X7R (EIA)	50	0.15μF ±10%	2.00	1.25	1.25
GRM21BR71H224KA01	X7R (EIA)	50	0.22μF ±10%	2.00	1.25	1.25
GRM21BR71H474KA88	X7R (EIA)	50	0.47μF ±10%	2.00	1.25	1.25
GRM21BR71E104KA01	X7R (EIA)	25	0.10μF ±10%	2.00	1.25	1.25
GRM21BR71E154KA01	X7R (EIA)	25	0.15μF ±10%	2.00	1.25	1.25
GRM21BR71E334KC01	X7R (EIA)	25	0.33μF ±10%	2.00	1.25	1.25
GRM21BR71E474KA01	X7R (EIA)	25	0.47μF ±10%	2.00	1.25	1.25
GRM21BR71E105KA99	X7R (EIA)	25	1.0μF ±10%	2.00	1.25	1.25
GRM21BR71C105KA01	X7R (EIA)	16	1.0μF ±10%	2.00	1.25	1.25
GRM319R71H334KA01	X7R (EIA)	50	0.33μF ±10%	3.20	1.60	0.85
GRM319R71E684KC01	X7R (EIA)	25	0.68μF ±10%	3.20	1.60	0.85
GRM319R71C105KC11	X7R (EIA)	16	1.0μF ±10%	3.20	1.60	0.85
GRM319R71A105KC01	X7R (EIA)	10	1.0μF ±10%	3.20	1.60	0.85
GRM31CR71H155KA88	X7R (EIA)	50	1.5μF ±10%	3.20	1.60	1.60
GRM31CR71H225KA88	X7R (EIA)	50	2.2μF ±10%	3.20	1.60	1.60
GRM31CR71E335KA88	X7R (EIA)	25	3.3μF ±10%	3.20	1.60	1.60
GRM31CR71E475KA88	X7R (EIA)	25	4.7μF ±10%	3.20	1.60	1.60
GRM31CR71C475KA01	X7R (EIA)	16	4.7μF ±10%	3.20	1.60	1.60
GRM31CR71A106KA01	X7R (EIA)	10	10μF ±10%	3.20	1.60	1.60
GRM31MR71H474KA01	X7R (EIA)	50	0.47μF ±10%	3.20	1.60	1.15
GRM31MR71H105KA88	X7R (EIA)	50	1.0μF ±10%	3.20	1.60	1.15
GRM31MR71E105KA01	X7R (EIA)	25	1.0μF ±10%	3.20	1.60	1.15
GRM31MR71E225KA93	X7R (EIA)	25	2.2μF ±10%	3.20	1.60	1.15
GRM31MR71C155KC11	X7R (EIA)	16	1.5μF ±10%	3.20	1.60	1.15
GRM31MR71C225KA35	X7R (EIA)	16	2.2μF ±10%	3.20	1.60	1.15
GRM31MR71A225KA01	X7R (EIA)	10	2.2μF ±10%	3.20	1.60	1.15
GRM32DR71C106KA01	X7R (EIA)	16	10μF ±10%	3.20	2.50	2.00
GRM32ER71H475KA88	X7R (EIA)	50	4.7μF ±10%	3.20	2.50	2.50
GRM32MR71C225KC01	X7R (EIA)	16	2.2μF ±10%	3.20	2.50	1.15
GRM32NR71H684KA01	X7R (EIA)	50	0.68μF ±10%	3.20	2.50	1.35
GRM32NR71C335KC01	X7R (EIA)	16	3.3μF ±10%	3.20	2.50	1.35
GRM32RR71H105KA01	X7R (EIA)	50	1.0μF ±10%	3.20	2.50	1.80
GRM32RR71E225KC01	X7R (EIA)	25	2.2μF ±10%	3.20	2.50	1.80
GRM32RR71C475KC01	X7R (EIA)	16	4.7μF ±10%	3.20	2.50	1.80
GRM43ER71H225KA01	X7R (EIA)	50	2.2μF ±10%	4.50	3.20	2.50
GRM43ER71E475KA01	X7R (EIA)	25	4.7μF ±10%	4.50	3.20	2.50
GRM55ER71H475KA01	X7R (EIA)	50	4.7μF ±10%	5.70	5.00	2.50
GRM55RR71H105KA01	X7R (EIA)	50	1.0μF ±10%	5.70	5.00	1.80
GRM55RR71H155KA01	X7R (EIA)	50	1.5μF ±10%	5.70	5.00	1.80
GRM033F51A222ZD01	Y5V (EIA)	10	2200pF +80/-20%	0.6	0.3	0.3
GRM033F51A472ZD01	Y5V (EIA)	10	4700pF +80/-20%	0.6	0.3	0.3
GRM033F51A103ZD01	Y5V (EIA)	10	10000pF +80/-20%	0.6	0.3	0.3
GRM155F51H222ZA01	Y5V (EIA)	50	2200pF +80/-20%	1.00	0.50	0.50
GRM155F51H472ZA01	Y5V (EIA)	50	4700pF +80/-20%	1.00	0.50	0.50
GRM155F51H103ZA01	Y5V (EIA)	50	10000pF +80/-20%	1.00	0.50	0.50
GRM155F51E223ZA01	Y5V (EIA)	25	22000pF +80/-20%	1.00	0.50	0.50
GRM155F51E473ZA01	Y5V (EIA)	25	47000pF +80/-20%	1.00	0.50	0.50
GRM155F51E104ZA01	Y5V (EIA)	25	0.10μF +80/-20%	1.00	0.50	0.50
GRM155F51C473ZA01	Y5V (EIA)	16	47000pF +80/-20%	1.00	0.50	0.50
GRM155F51C104ZA01	Y5V (EIA)	16	0.10μF +80/-20%	1.00	0.50	0.50

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Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM188F51H103ZA01	Y5V (EIA)	50	10000pF +80/-20%	1.60	0.80	0.80
GRM188F51H223ZA01	Y5V (EIA)	50	22000pF +80/-20%	1.60	0.80	0.80
GRM188F51H473ZA01	Y5V (EIA)	50	47000pF +80/-20%	1.60	0.80	0.80
GRM188F51H104ZA01	Y5V (EIA)	50	0.10μF +80/-20%	1.60	0.80	0.80
GRM188F51H224ZA01	Y5V (EIA)	50	0.22μF +80/-20%	1.60	0.80	0.80
GRM188F51E104ZA01	Y5V (EIA)	25	0.10μF +80/-20%	1.60	0.80	0.80
GRM188F51E474ZA01	Y5V (EIA)	25	0.47μF +80/-20%	1.60	0.80	0.80
GRM188F51C224ZA01	Y5V (EIA)	16	0.22μF +80/-20%	1.60	0.80	0.80
GRM188F51C474ZA01	Y5V (EIA)	16	0.47μF +80/-20%	1.60	0.80	0.80
GRM188F51C105ZA01	Y5V (EIA)	16	1.0μF +80/-20%	1.60	0.80	0.80
GRM188F51A474ZA01	Y5V (EIA)	10	0.47μF +80/-20%	1.60	0.80	0.80
GRM188F51A105ZA01	Y5V (EIA)	10	1.0μF +80/-20%	1.60	0.80	0.80
GRM216F51H224ZA01	Y5V (EIA)	50	0.22μF +80/-20%	2.00	1.25	0.60
GRM216F51E474ZA01	Y5V (EIA)	25	0.47μF +80/-20%	2.00	1.25	0.60
GRM219F51H104ZA01	Y5V (EIA)	50	0.10μF +80/-20%	2.00	1.25	0.85
GRM219F51H474ZA01	Y5V (EIA)	50	0.47μF +80/-20%	2.00	1.25	0.85
GRM219F51H105ZA01	Y5V (EIA)	50	1.0μF +80/-20%	2.00	1.25	0.85
GRM219F51E224ZA01	Y5V (EIA)	25	0.22μF +80/-20%	2.00	1.25	0.85
GRM219F51E105ZA01	Y5V (EIA)	25	1.0μF +80/-20%	2.00	1.25	0.85
GRM219F51C105ZA01	Y5V (EIA)	16	1.0μF +80/-20%	2.00	1.25	0.85
GRM219F51A105ZA01	Y5V (EIA)	10	1.0μF +80/-20%	2.00	1.25	0.85
GRM21BF51H224ZA01	Y5V (EIA)	50	0.22μF +80/-20%	2.00	1.25	1.25
GRM21BF51E474ZA01	Y5V (EIA)	25	0.47μF +80/-20%	2.00	1.25	1.25
GRM21BF51E225ZA01	Y5V (EIA)	25	2.2μF +80/-20%	2.00	1.25	1.25
GRM21BF51C225ZA01	Y5V (EIA)	16	2.2μF +80/-20%	2.00	1.25	1.25
GRM21BF51A225ZA01	Y5V (EIA)	10	2.2μF +80/-20%	2.00	1.25	1.25
GRM21BF51A475ZA01	Y5V (EIA)	10	4.7μF +80/-20%	2.00	1.25	1.25
GRM319F51C105ZA01	Y5V (EIA)	16	1.0μF +80/-20%	3.20	1.60	0.85
GRM319F51A225ZA01	Y5V (EIA)	10	2.2μF +80/-20%	3.20	1.60	0.85
GRM31CF51H475ZA01	Y5V (EIA)	50	4.7μF +80/-20%	3.20	1.60	1.60
GRM31CF51E106ZA01	Y5V (EIA)	25	10μF +80/-20%	3.20	1.60	1.60
GRM31MF51H474ZA01	Y5V (EIA)	50	0.47μF +80/-20%	3.20	1.60	1.15
GRM31MF51E105ZA01	Y5V (EIA)	25	1.0μF +80/-20%	3.20	1.60	1.15
GRM31MF51E475ZA01	Y5V (EIA)	25	4.7μF +80/-20%	3.20	1.60	1.15
GRM31MF51C225ZA01	Y5V (EIA)	16	2.2μF +80/-20%	3.20	1.60	1.15
GRM31MF51C475ZA01	Y5V (EIA)	16	4.7μF +80/-20%	3.20	1.60	1.15
GRM31MF51A475ZA01	Y5V (EIA)	10	4.7μF +80/-20%	3.20	1.60	1.15
GRM31MF51A106ZA01	Y5V (EIA)	10	10μF +80/-20%	3.20	1.60	1.15
GRM31MF50J106ZA01	Y5V (EIA)	6.3	10μF +80/-20%	3.20	1.60	1.15
GRM329F51E475ZA01	Y5V (EIA)	25	4.7μF +80/-20%	3.20	2.50	0.85
GRM32DF51H106ZA01	Y5V (EIA)	50	10μF +80/-20%	3.20	2.50	2.00
GRM32NF51E106ZA01	Y5V (EIA)	25	10μF +80/-20%	3.20	2.50	1.35
GRM32NF51C106ZA01	Y5V (EIA)	16	10μF +80/-20%	3.20	2.50	1.35
GRM32RF51H105ZA01	Y5V (EIA)	50	1.0μF +80/-20%	3.20	2.50	1.8
GRM188E41H103MA01	Z5U (EIA)	50	10000pF ±20%	1.60	0.80	0.80
GRM188E41H223MA01	Z5U (EIA)	50	22000pF ±20%	1.60	0.80	0.80
GRM216E41H473MA01	Z5U (EIA)	50	47000pF ±20%	2.00	1.25	0.60
GRM219E41H104MA01	Z5U (EIA)	50	0.10μF ±20%	2.00	1.25	0.85
GRM319E41H224MA01	Z5U (EIA)	50	0.22μF ±20%	3.20	1.60	0.85

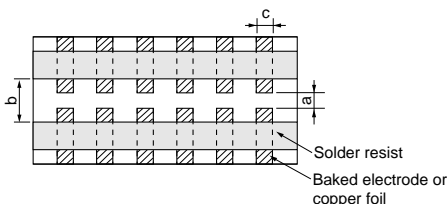
 **Note** • This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering. Especially, please read rating and **CAUTION** (for storage, operating, rating, soldering, mounting and handling) in them to prevent smoking and/or burning, etc.
• You are able to read a detailed specifications in the website (<http://search.murata.co.jp/>) before to require our product specifications or to transact the approval sheet for product specifications.


■ Specifications and Test Methods

No.	Item	Specifications		Test Method												
		Temperature Compensating Type	High Dielectric Type													
1	Operating Temperature Range	−55 to +125℃	B1, B3, F1 : −25℃ to +85℃ R1, R7 : −55℃ to +125℃ E4 : +10℃ to +85℃ F5 : −30℃ to +85℃	Reference Temperature : 25℃ (2Δ, 3Δ, 4Δ, B1, B3, F1, R1 : 20℃)												
2	Rated Voltage	See the previous pages		The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{0-P} , whichever is larger, should be maintained within the rated voltage range.												
3	Appearance	No defects or abnormalities		Visual inspection												
4	Dimensions	Within the specified dimensions		Using calipers												
5	Dielectric Strength	No defects or abnormalities		No failure should be observed when 300% of the rated voltage (temperature compensating type) or 250% of the rated voltage (high dielectric constant type) is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.												
6	Insulation Resistance	$C \leq 0.047\mu F$: More than 10,000MΩ $C > 0.047\mu F$: 500Ω • F C : Nominal Capacitance		The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at 20℃/25℃ and 75%RH max. and within 2 minutes of charging, provided the charge/discharge current is less than 50mA.												
7	Capacitance	Within the specified tolerance		The capacitance/D.F. should be measured at 20℃/25℃ at the frequency and voltage shown in the table.												
8	Q/ Dissipation Factor (D.F.)	30pF and over : $Q \geq 1000$ 30pF and below : $Q \geq 400 + 20C$ C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V/4V : 0.05max. (C<3.3μF) : 0.1max. (C≥3.3μF) [F1, F5] W.V. : 25Vmin. : 0.05max. (C<0.1μF) : 0.09max. (C≥0.1μF) W.V. : 16V/10V : 0.125max. W.V. : 6.3V : 0.15max.	<table><tr><th>Char. Item</th><th>ΔC to ΔU, 1X (1000pF and below)</th><th>ΔC to ΔU, 1X (more than 1000pF) R6, R7, F5 B1, B3, F1</th><th>E4</th></tr><tr><td>Frequency</td><td>1±0.1MHz</td><td>1±0.1kHz</td><td>1±0.1kHz</td></tr><tr><td>Voltage</td><td>0.5 to 5Vrms</td><td>1±0.2Vrms</td><td>0.5±0.05Vrms</td></tr></table>	Char. Item	ΔC to ΔU, 1X (1000pF and below)	ΔC to ΔU, 1X (more than 1000pF) R6, R7, F5 B1, B3, F1	E4	Frequency	1±0.1MHz	1±0.1kHz	1±0.1kHz	Voltage	0.5 to 5Vrms	1±0.2Vrms	0.5±0.05Vrms
Char. Item	ΔC to ΔU, 1X (1000pF and below)	ΔC to ΔU, 1X (more than 1000pF) R6, R7, F5 B1, B3, F1	E4													
Frequency	1±0.1MHz	1±0.1kHz	1±0.1kHz													
Voltage	0.5 to 5Vrms	1±0.2Vrms	0.5±0.05Vrms													

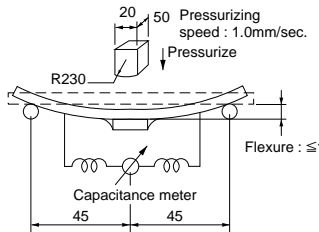
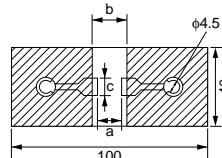
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No.	Item		Specifications		Test Method																																			
			Temperature Compensating Type	High Dielectric Type																																				
9	Capacitance Temperature Characteristics	No bias	Within the specified tolerance (Table A-1)	B1, B3 : Within±10% (−25℃ to +85℃) R1, R7 : Within±15% (−55℃ to +125℃) R6 : Within±15% (−55℃ to +85℃) E4 : Within +22/−56% (+10℃ to +85℃) F1 : Within +30/−80% (−25℃ to +85℃) F5 : Within +22/−82% (−30℃ to +85℃)	<p>The capacitance change should be measured after 5min. at each specified temp. stage.</p> <p>(1)Temperature Compensating Type</p> <p>The temperature coefficient is determinind using the capacitance measured in step 3 as a reference.</p> <p>When cycling the temperature sequentially from step 1 through 5 (5C : +25℃ to +125℃/ΔC : +20℃ to +125℃ : other temp. coeffs. : +25℃ to +85℃/+20℃ to +85℃) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A-1.</p> <p>The capacitance drift is calaculated by dividing the differences between the maximum and minimum measured values in the step 1, 3 and 5 by the cap. value in step 3.</p> <table><tr><th>Step</th><th>Temperature (℃)</th></tr><tr><td>1</td><td>Reference Temperature±2</td></tr><tr><td>2</td><td>−55±3 (for ΔC)/−25±3 (for other TC)</td></tr><tr><td>3</td><td>Reference Temperature±2</td></tr><tr><td>4</td><td>125±3 (for ΔC)/85±3 (for other TC)</td></tr><tr><td>5</td><td>Reference Temperature±2</td></tr></table> <p>(2) High Dielectric Constant Type</p> <p>The ranges of capacitance change compared with the 20℃ value over the temperature ranges shown in the table should be within the specified ranges.*</p> <p>In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage.</p> <table><tr><th>Step</th><th>Temperature (℃)</th><th>Applying Voltage (V)</th></tr><tr><td>1</td><td>Reference Tempereture±2</td><td rowspan="4">No bias</td></tr><tr><td>2</td><td>−55±3 (for R1, R7, R6) −25±3 (for B1, B3, F1) −30±3 (for F5)/10±3 (for E4)</td></tr><tr><td>3</td><td>Reference Tempereture±2</td></tr><tr><td>4</td><td>125±3 (for R1, R7)/ 85±3 (for B1, B3, R6 F1, F5, E4)</td></tr><tr><td>5</td><td>Reference Temperature±2</td><td rowspan="4">50% of the rated voltage</td></tr><tr><td>6</td><td>−55±3 (for R1)/ −25±3 (for B1, F1)</td></tr><tr><td>7</td><td>Reference Tempereture±2</td></tr><tr><td>8</td><td>125±3 (for R1)/ 85±3 (for B1, F1)</td></tr></table>	Step	Temperature (℃)	1	Reference Temperature±2	2	−55±3 (for ΔC)/−25±3 (for other TC)	3	Reference Temperature±2	4	125±3 (for ΔC)/85±3 (for other TC)	5	Reference Temperature±2	Step	Temperature (℃)	Applying Voltage (V)	1	Reference Tempereture±2	No bias	2	−55±3 (for R1, R7, R6) −25±3 (for B1, B3, F1) −30±3 (for F5)/10±3 (for E4)	3	Reference Tempereture±2	4	125±3 (for R1, R7)/ 85±3 (for B1, B3, R6 F1, F5, E4)	5	Reference Temperature±2	50% of the rated voltage	6	−55±3 (for R1)/ −25±3 (for B1, F1)	7	Reference Tempereture±2	8	125±3 (for R1)/ 85±3 (for B1, F1)		
		Step	Temperature (℃)																																					
		1	Reference Temperature±2																																					
2	−55±3 (for ΔC)/−25±3 (for other TC)																																							
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Step	Temperature (℃)	Applying Voltage (V)																																						
1	Reference Tempereture±2	No bias																																						
2	−55±3 (for R1, R7, R6) −25±3 (for B1, B3, F1) −30±3 (for F5)/10±3 (for E4)																																							
3	Reference Tempereture±2																																							
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6	−55±3 (for R1)/ −25±3 (for B1, F1)																																							
7	Reference Tempereture±2																																							
8	125±3 (for R1)/ 85±3 (for B1, F1)																																							
50% of the Rated Voltage			B1 : Within +10/−30% R1 : Within +15/−40% F1 : Within +30/−95%																																					
Capacitance Drift			Within ±0.2% or ±0.05pF (Whichever is larger.) *Not apply to 1X/25V																																					
10	Adhesive Strength of Termination	No removal of the terminations or other defect should occur		<p>Solder the capacitor to the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10±1 sec.</p> <p>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <p>*2N (GR□03), 5N (GR□15, GRM18)</p> <table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GR□03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>GR□15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table>	Type	a	b	c	GR□03	0.3	0.9	0.3	GR□15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55	4.5	8.0	5.6
		Type	a		b	c																																		
GR□03	0.3	0.9	0.3																																					
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GRM55	4.5	8.0	5.6																																					
																																								

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No.	Item		Specifications		Test Method																																			
			Temperature Compensating Type	High Dielectric Type																																				
11	Vibration Resistance	Appearance	No defects or abnormalities		Solder the capacitor on the test jig (glass epoxy board) in the same manner and under the same conditions as (10). The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).																																			
		Capacitance	Within the specified tolerance																																					
		Q/D.F.	30pF and over : $Q \geq 1000$ 30pF and below : $Q \geq 400+20C$ C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V/4V : 0.05max. (C<3.3μF) : 0.1max. (C≥3.3μF) [F1, F5] W.V. : 25Vmin. : 0.05max. (C<0.1μF) : 0.09max. (C≥0.1μF) W.V. : 16V/10V : 0.125max. W.V. : 6.3V : 0.15max.																																				
12	Deflection	No crack or marked defect should occur		Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a for 5±1sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.																																				
		 Fig. 3a																																						
13	Solderability of Termination	75% of the terminations are to be soldered evenly and continuously		Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion) . Preheat at 80 to 120°C for 10 to 30 seconds. After preheating, immerse in an eutectic solder solution for 2±0.5 seconds at 230±5°C.																																				
14	Resistance to Soldering Heat	The measured and observed characteristics should satisfy the specifications in the following table			Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in an eutectic solder solution at 270±5°C for 10±0.5 seconds. Set at room temperature for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type), then measure. •Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/-10°C for one hour and then set at room temperature for 48±4 hours. Perform the initial measurement. •Preheating for GRM32/43/55																																			
		Appearance	No defects or abnormalities																																					
		Capacitance Change	Within ±2.5% or ±0.25pF (Whichever is larger)	B1, B3, R1, R6, R7 : Within ±7.5% F1, F5, E4 : Within ±20%																																				
		Q/D.F.	30pF and over : $Q \geq 1000$ 30pF and below : $Q \geq 400+20C$ C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V/4V : 0.05max. (C<3.3μF) : 0.1max. (C≥3.3μF) [F1, F5] W.V. : 25Vmin. : 0.05max. (C<0.1μF) : 0.09max. (C≥0.1μF) W.V. : 16V/10V : 0.125max. W.V. : 6.3V : 0.15max.																																				
		I.R.	More than 10,000MΩ or 500Ω • F (Whichever is smaller)																																					
		Dielectric Strength	No defects																																					
 Fig. 2a t : 1.6mm (GR□03/15 : t : 0.8mm)																																								
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GR□03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>GR□15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table> (in mm)					Type	a	b	c	GR□03	0.3	0.9	0.3	GR□15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55	4.5	8.0	5.6
Type	a	b	c																																					
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No.	Item	Specifications		Test Method															
		Temperature Compensating Type	High Dielectric Type																
15	Temperature Cycle		The measured and observed characteristics should satisfy the specifications in the following table																
		Appearance	No defects or abnormalities																
		Capacitance Change	Within $\pm 2.5\%$ or $\pm 0.25\text{pF}$ (Whichever is larger)	B1, B3, R1, R6, R7 : Within $\pm 7.5\%$ F1, F5, E4 : Within $\pm 20\%$															
		Q/D.F.	30pF and over : $Q \geq 1000$ 30pF and below : $Q \geq 400 + 20\text{C}$ C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.025max. W.V. : 16/10V : 0.035max. W.V. : 6.3V/4V : 0.05max. (C<3.3μF) : 0.1max. (C \geq 3.3μF) [F1, F5] W.V. : 25Vmin. : 0.05max. (C<0.1μF) : 0.09max. (C \geq 0.1μF) W.V. : 16V/10V : 0.125max. W.V. : 6.3V : 0.15max.															
		I.R.	More than 10,000MΩ or 500Ω • F (Whichever is smaller)																
		Dielectric Strength	No defects																
16	Humidity (Steady State)		The measured and observed characteristics should satisfy the specifications in the following table																
		Appearance	No defects or abnormalities																
		Capacitance Change	Within $\pm 5\%$ or $\pm 0.5\text{pF}$ (Whichever is larger)	B1, B3, R1, R6, R7, C8 : Within $\pm 12.5\%$ F1, F5 : Within $\pm 30\%$															
		Q/D.F.	30pF and over : $Q \geq 350$ 10pF and over : $Q \geq 275 + 2.5\text{C}$ 30pF and below : $Q \geq 200 + 10\text{C}$ C : Nominal Capacitance (pF)	[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.05max. W.V. : 16/10V : 0.05max. W.V. : 6.3V/4V : 0.075max. (C<3.3μF) : 0.125max. (C \geq 3.3μF) [F1, F5] W.V. : 25Vmin. : 0.075max. (C<0.1μF) : 0.125max. (C \geq 0.1μF) W.V. : 16V/10V : 0.15max. W.V. : 6.3V : 0.2max.															
		I.R.	More than 1,000MΩ or 50Ω • F (Whichever is smaller)																
				<p>Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10). Perform the five cycles according to the four heat treatments shown in the following table.</p> <p>Set for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.</p> <table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>Min. Operating Temp.+0/−3</td><td>Room Temp.</td><td>Max. Operating Temp.+3/−0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30±3</td><td>2 to 3</td><td>30±3</td><td>2 to 3</td></tr></table> <p>•Initial measurement for high dielectric constant type Perform a heat treatment at 150+0/−10°C for one hour and then set at room temperature for 48±4 hours. Perform the initial measurement.</p>	Step	1	2	3	4	Temp. (°C)	Min. Operating Temp.+0/−3	Room Temp.	Max. Operating Temp.+3/−0	Room Temp.	Time (min.)	30±3	2 to 3	30±3	2 to 3
Step	1	2	3	4															
Temp. (°C)	Min. Operating Temp.+0/−3	Room Temp.	Max. Operating Temp.+3/−0	Room Temp.															
Time (min.)	30±3	2 to 3	30±3	2 to 3															
				<p>Set the capacitor at 40±2°C and in 90 to 95% humidity for 500±12 hours. Remove and set for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure.</p>															

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No.	Item	Specifications		Test Method	
		Temperature Compensating Type	High Dielectric Type		
17	Humidity Load	The measured and observed characteristics should satisfy the specifications in the following table		Apply the rated voltage at 40±2℃ and 90 to 95% humidity for 500±12 hours. Remove and set for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temprature, then muasure. The charge/discharge current is less than 50mA. •Initial measurement for F1, F5/10V max. Apply the rated DC voltage for 1 hour at 40±2℃. Remove and set for 48±4 hours at room temperature. Perform initial measurement.	
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±7.5% or ±0.75pF (Whichever is larger)		B1, B3, R1, R6, R7 : Within ±12.5% F1, F5, E4 : Within ±30% [W.V. : 10Vmax.] F1, F5 : Within +30/−40%
		Q/D.F.	30pF and over : Q≥200 30pF and below : Q≥100+10C/3 C : Nominal Capacitance (pF)		[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.05max. W.V. : 16/10V : 0.05max. W.V. : 6.3V : 0.075max. (C<3.3μF) : 0.125max. (C≥3.3μF) [F1, F5] W.V. : 25Vmin. : 0.075max. (C<0.1μF) : 0.125max. (C≥0.1μF) W.V. : 16V/10V : 0.15max. W.V. : 6.3V : 0.2max.
		I.R.	More than 500MΩ or 25Ω • F (Whichever is smaller)		
18	High Temperature Load	The measured and observed characteristics should satisfy the specifications in the following table		Apply 200% of the rated voltage at the maximum operating temperature ±3℃ for 1000±12 hours. Set for 24±2 hours (temperature compensating type) or 48±4 hours (high dielectric constant type) at room temperature, then measure. The charge/discharge current is less than 50mA. •Initial measurement for high dielectric constant type. Apply 200% of the rated DC voltage at the maximun operating temperature ±3℃ for one hour. Remove and set for 48±4 hours at room temperature. Perform initial measurement.	
		Appearance	No defects or abnormalities		
		Capacitance Change	Within ±3% or ±0.3pF (Whichever is larger)		B1, B3, R1, R6, R7 : Within ±12.5% F1, F5, E4 : Within ±30% [Except 10Vmax. and. C≥1.0μF] F1, F5 : Within +30/−40% [10Vmax. and. C≥1.0μF]
		Q/D.F.	30pF and over : Q≥350 10pF and over : Q≥275+2.5C 30pF and below : Q≥200+10C 10pF and below : Q≥200+10C C : Nominal Capacitance (pF)		[B1, B3, R1, R6, R7, E4] W.V. : 25Vmin. : 0.04max. W.V. : 16/10V : 0.05max. W.V. : 6.3V : 0.075max.(C<3.3μF) : 0.125max.(C≥3.3μF) [F1, F5] W.V. : 25Vmin. : 0.075max.(C<0.1μF) : 0.125max.(C≥0.1μF) W.V. : 16V/10V : 0.15max. W.V. : 6.3V : 0.2max.
		I.R.	More than 1,000MΩ or 50Ω•F (Whichever is smaller)		

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Table A-1

(1)

Char.	Nominal Values (ppm/°C)*1	Capacitance Change from 25°C (%)					
		-55		-30		-10	
		Max.	Min.	Max.	Min.	Max.	Min.
5C	0± 30	0.58	-0.24	0.40	-0.17	0.25	-0.11
6C	0± 60	0.87	-0.48	0.59	-0.33	0.38	-0.21
6P	-150± 60	2.33	0.72	1.61	0.50	1.02	0.32
6R	-220± 60	3.02	1.28	2.08	0.88	1.32	0.56
6S	-330± 60	4.09	2.16	2.81	1.49	1.79	0.95
6T	-470± 60	5.46	3.28	3.75	2.26	2.39	1.44
7U	-750±120	8.78	5.04	6.04	3.47	3.84	2.21
1X	+350 to -1000	—	—	—	—	—	—

*1Nominal values denote the temperature coefficient within a range of 25°C to 125°C (for ΔC)/85°C (for other TC).

(2)

Char.	Nominal Values (ppm/°C)*2	Capacitance Change from 20°C (%)					
		-55		-25		-10	
		Max.	Min.	Max.	Min.	Max.	Min.
2C	0± 60	0.82	-0.45	0.49	-0.27	0.33	-0.18
3C	0±120	1.37	-0.90	0.82	-0.54	0.55	-0.36
4C	0±250	2.56	-1.88	1.54	-1.13	1.02	-0.75
2P	-150± 60	—	—	1.32	0.41	0.88	0.27
3P	-150±120	—	—	1.65	0.14	1.10	0.09
4P	-150±250	—	—	2.36	-0.45	1.57	-0.30
2R	-220± 60	—	—	1.70	0.72	1.13	0.48
3R	-220±120	—	—	2.03	0.45	1.35	0.30
4R	-220±250	—	—	2.74	-0.14	1.83	-0.09
2S	-330± 60	—	—	2.30	1.22	1.54	0.81
3S	-330±120	—	—	2.63	0.95	1.76	0.63
4S	-330±250	—	—	3.35	0.36	2.23	0.24
2T	-470± 60	—	—	3.07	1.85	2.05	1.23
3T	-470±120	—	—	3.40	1.58	2.27	1.05
4T	-470±250	—	—	4.12	0.99	2.74	0.66
3U	-750±120	—	—	4.94	2.84	3.29	1.89
4U	-750±250	—	—	5.65	2.25	3.77	1.50

*2Nominal values denote the temperature coefficient within a range of 20°C to 125°C (for ΔC)/85°C (for other TC).

Monolithic Ceramic Capacitors GR_R6/R7/F5/E4 (X5R/X7R/Y5V/Z5U)

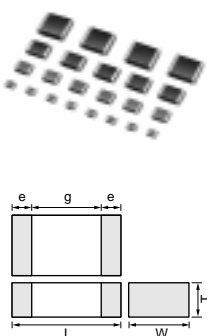
High Dielectric Constant Type 100V

Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM188R72A222KA01	X7R (EIA)	100	2200pF ±10%	1.60	0.80	0.80
GRM188R72A332KA01	X7R (EIA)	100	3300pF ±10%	1.60	0.80	0.80
GRM188F52A472ZD01	Y5V (EIA)	100	4700pF +80/-20%	1.60	0.80	0.80
GRM219R72A472KA01	X7R (EIA)	100	4700pF ±10%	2.00	1.25	0.85
GRM219R72A682KA01	X7R (EIA)	100	6800pF ±10%	2.00	1.25	0.85
GRM21BR72A103KA01	X7R (EIA)	100	10000pF ±10%	2.00	1.25	1.25
GRM31MR72A333KA01	X7R (EIA)	100	33000pF ±10%	3.20	1.60	1.15
GRM31MR72A473KA01	X7R (EIA)	100	47000pF ±10%	3.20	1.60	1.15
GRM32ER72A105KA01	X7R (EIA)	100	1.0μF ±10%	3.20	2.50	2.50
GRM32NR72A683KA01	X7R (EIA)	100	68000pF ±10%	3.20	2.50	1.35
GRM32NF52A104ZA01	Y5V (EIA)	100	0.10μF +80/-20%	3.20	2.50	1.35
GRM32NR72A104KA01	X7R (EIA)	100	0.10μF ±10%	3.20	2.50	1.35
GRM43DR72A474KA01	X7R (EIA)	100	0.47μF ±10%	4.50	3.20	2.00
GRM43ER72A225KA01	X7R (EIA)	100	2.2μF ±10%	4.50	3.20	2.50
GRM43RR72A154KA01	X7R (EIA)	100	0.15μF ±10%	4.50	3.20	1.80
GRM43RR72A224KA01	X7R (EIA)	100	0.22μF ±10%	4.50	3.20	1.80
GRM55DR72A105KA01	X7R (EIA)	100	1.0μF ±10%	5.70	5.00	2.00
GRM55ER72A475KA01	X7R (EIA)	100	4.7μF ±10%	5.70	5.00	2.50
GRM55RF52A474ZA01	Y5V (EIA)	100	0.47μF +80/-20%	5.70	5.00	1.80

Monolithic Ceramic Capacitors GR_R6/R7/F5/E4 (X5R/X7R/Y5V/Z5U)

Thin Layer Large-Capacitance type


Part Number	Dimensions (mm)				
	L	W	T	e min.	g min.
GRM033	0.6 ±0.03	0.3 ±0.03	0.3 ±0.03	0.1 to 0.2	0.2
GRM155	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15 to 0.3	0.4
GRM185	1.6 ±0.1	0.8 ±0.1	0.5 ±0/-0.1	0.2 to 0.5	0.5
GRM188	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.2 to 0.5	0.5
GRM216			0.6 ±0.1		
GRM219	2.0 ±0.1	1.25 ±0.1	0.85 ±0.1	0.2 to 0.7	0.7
GRM21B			1.25 ±0.1		
GRM316			0.6 ±0.1		
GRM319	3.2 ±0.15	1.6 ±0.15	0.85 ±0.1	0.3 to 0.8	1.5
GRM31M			1.15 ±0.1		
GRM31C	3.2 ±0.2	1.6 ±0.2	1.6 ±0.2		
GRM32C			1.6 ±0.2		
GRM32D	3.2 ±0.3	2.5 ±0.2	2.0 ±0.2	0.3	1.0
GRM32E			2.5 ±0.2		
GRM43D			2.0 ±0.2		
GRM43E	4.5 ±0.4	3.2 ±0.3	2.5 ±0.2	0.3	2.0
GRM43S			2.8 ±0.2		
GRM55F	5.7 ±0.4	5.0 ±0.4	3.2 ±0.2	0.3	2.0



Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM033R60J153KE01	X5R (EIA)	6.3	15000pF ±10%	0.6	0.3	0.3
GRM033R60J223KE01	X5R (EIA)	6.3	22000pF ±10%	0.6	0.3	0.3
GRM033R60J333KE01	X5R (EIA)	6.3	33000pF ±10%	0.6	0.3	0.3
GRM033R60J393KE19	X5R (EIA)	6.3	39000pF ±10%	0.6	0.3	0.3
GRM033R60J473KE19	X5R (EIA)	6.3	47000pF ±10%	0.6	0.3	0.3
GRM033R60J104KE19	X5R (EIA)	6.3	0.10μF ±10%	0.6	0.3	0.3
GRM155R60J154KE01	X5R (EIA)	6.3	0.15μF ±10%	1.00	0.50	0.50
GRM155R60J224KE01	X5R (EIA)	6.3	0.22μF ±10%	1.00	0.50	0.50
GRM155R60J334KE01	X5R (EIA)	6.3	0.33μF ±10%	1.00	0.50	0.50
GRM155R60J474KE19	X5R (EIA)	6.3	0.47μF ±10%	1.00	0.50	0.50
GRM155R60J105KE19	X5R (EIA)	6.3	1.0μF ±10%	1.00	0.50	0.50
GRM185R60J105KE21	X5R (EIA)	6.3	1.0μF ±10%	1.60	0.80	0.50
GRM185R60J105KE26	X5R (EIA)	6.3	1.0μF ±10%	1.60	0.80	0.50

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• You are able to read a detailed specifications in the website (<http://search.murata.co.jp/>) before to require our product specifications or to transact the approval sheet for product specifications.

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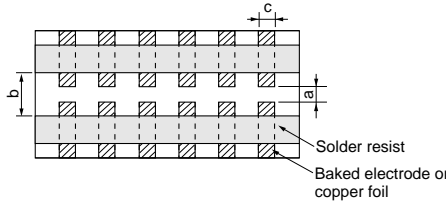
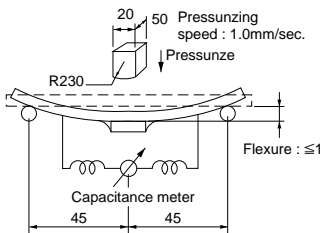
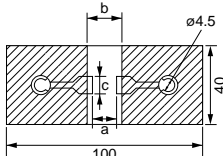
Part Number	TC Code	Rated Voltage (Vdc)	Capacitance*	Length L (mm)	Width W (mm)	Thickness T (mm)
GRM185R60J225KE26	X5R (EIA)	6.3	2.2μF ±10%	1.60	0.80	0.50
GRM188R60J225KE01	X5R (EIA)	6.3	2.2μF ±10%	1.60	0.80	0.80
GRM188R60J225KE19	X5R (EIA)	6.3	2.2μF ±10%	1.60	0.80	0.80
GRM188R60J475KE19	X5R (EIA)	6.3	4.7μF ±10%	1.60	0.80	0.80
GRM219R60J475KE01	X5R (EIA)	6.3	4.7μF ±10%	2.00	1.25	0.85
GRM219R60J475KE19	X5R (EIA)	6.3	4.7μF ±10%	2.00	1.25	0.85
GRM219R60J475KE32	X5R (EIA)	6.3	4.7μF ±10%	2.00	1.25	0.85
GRM219R60J106KE19	X5R (EIA)	6.3	10μF ±10%	2.00	1.25	0.85
GRM219R60J106ME19	X5R (EIA)	6.3	10μF ±20%	2.00	1.25	0.85
GRM21BR60J106KE01	X5R (EIA)	6.3	10μF ±10%	2.00	1.25	1.25
GRM21BR60J106KE19	X5R (EIA)	6.3	10μF ±10%	2.00	1.25	1.25
GRM21BR60J106ME01	X5R (EIA)	6.3	10μF ±20%	2.00	1.25	1.25
GRM21BR60J106ME19	X5R (EIA)	6.3	10μF ±20%	2.00	1.25	1.25
GRM21BR60J226ME39	X5R (EIA)	6.3	22μF ±20%	2.00	1.25	1.25
GRM319R60J106KE01	X5R (EIA)	6.3	10μF ±10%	3.20	0.85	1.60
GRM31CR60J156KE19	X5R (EIA)	6.3	15μF ±10%	3.20	1.60	1.60
GRM31CR60J226KE19	X5R (EIA)	6.3	22μF ±10%	3.20	1.60	1.60
GRM31CR60J226ME19	X5R (EIA)	6.3	22μF ±20%	3.20	1.60	1.60
GRM32DR60J226KA01	X5R (EIA)	6.3	22μF ±10%	3.20	2.50	2.00
GRM32DR60J336ME19	X5R (EIA)	6.3	33μF ±10%	3.20	2.50	2.00
GRM32ER60J476ME20	X5R (EIA)	6.3	47μF ±20%	3.20	2.50	2.50
GRM32ER60J107ME20	X5R (EIA)	6.3	100μF ±20%	3.20	2.50	2.50
GRM43DR60J336KE01	X5R (EIA)	6.3	33μF ±10%	4.50	3.20	2.00
GRM43ER60J476KE01	X5R (EIA)	6.3	47μF ±10%	4.50	3.20	2.50
GRM43SR60J107ME20	X5R (EIA)	6.3	100μF ±20%	4.50	3.20	2.80
GRM155F50J105ZE01	Y5V (EIA)	6.3	1.0μF +80/-20%	1.00	0.50	0.50
GRM188F50J225ZE01	Y5V (EIA)	6.3	2.2μF +80/-20%	1.60	0.80	0.80
GRM188F50J475ZE20	Y5V (EIA)	6.3	4.7μF +80/-20%	1.60	0.80	0.80
GRM21BF50J106ZE01	Y5V (EIA)	6.3	10μF +80/-20%	2.00	1.25	1.25
GRM31CF50J226ZE01	Y5V (EIA)	6.3	22μF +80/-20%	3.20	1.60	1.60
GRM32EF50J107ZE20	Y5V (EIA)	6.3	100μF +80/-20%	3.20	2.50	2.50


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No.	Item		Specifications	Test Method																			
1	Operating Temperature Range		B1, B3, F1 : -25℃ to +85℃ R6 : -55℃ to +85℃ F5 : -30℃ to +85℃ C8 : -55℃ to +105℃, C7 : -55℃ to +125℃	Reference Temperature : 25℃ (B1, B3, F1 : 20℃)																			
2	Rated Voltage		See the previous pages	The rated voltage is defined as the maximum voltage which may be applied continuously to the capacitor. When AC voltage is superimposed on DC voltage, V^{P-P} or V^{O-P} , whichever is larger, should be maintained within the rated voltage range.																			
3	Appearance		No defects or abnormalities	Visual inspection																			
4	Dimensions		Within the specified dimensions	Using calipers																			
5	Dielectric Strength		No defects or abnormalities	No failure should be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, provided the charge/discharge current is less than 50mA.																			
6	Insulation Resistance		More than 50Ω • F	The insulation resistance should be measured with a DC voltage not exceeding the rated voltage at Reference Temperature and 75%RH max. and within 1 minutes of charging, provided the charge/discharge current is less than 50mA.																			
7	Capacitance		Within the specified tolerance *Table 1 <table><tr><td>GRM155 B3/R6 1A 124 to 224</td></tr><tr><td>GRM185 B3/R6 1A 105</td></tr><tr><td>GRM188 B3/R6 1C/1A 225</td></tr><tr><td>GRM219 B3/R6 1A 475</td></tr><tr><td>GRM21B B3/R6 1C/1A 106</td></tr></table>	GRM155 B3/R6 1A 124 to 224	GRM185 B3/R6 1A 105	GRM188 B3/R6 1C/1A 225	GRM219 B3/R6 1A 475	GRM21B B3/R6 1C/1A 106	The capacitance should be measured at Reference Temperature at the frequency and voltage shown in the table. <table><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr><tr><td>$C \leq 10\mu\text{F}$ (10V min.)*1</td><td>1±0.1kHz</td><td>1.0±0.2Vrms</td></tr><tr><td>$C \leq 10\mu\text{F}$ (6.3V max.)</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr><tr><td>$C > 10\mu\text{F}$</td><td>120±24Hz</td><td>0.5±0.1Vrms</td></tr></table> *1 However the Voltage is 0.5+/-0.1Vrms about Table 1 items on the left side.	Capacitance	Frequency	Voltage	$C \leq 10\mu\text{F}$ (10V min.)*1	1±0.1kHz	1.0±0.2Vrms	$C \leq 10\mu\text{F}$ (6.3V max.)	1±0.1kHz	0.5±0.1Vrms	$C > 10\mu\text{F}$	120±24Hz	0.5±0.1Vrms		
GRM155 B3/R6 1A 124 to 224																							
GRM185 B3/R6 1A 105																							
GRM188 B3/R6 1C/1A 225																							
GRM219 B3/R6 1A 475																							
GRM21B B3/R6 1C/1A 106																							
Capacitance	Frequency	Voltage																					
$C \leq 10\mu\text{F}$ (10V min.)*1	1±0.1kHz	1.0±0.2Vrms																					
$C \leq 10\mu\text{F}$ (6.3V max.)	1±0.1kHz	0.5±0.1Vrms																					
$C > 10\mu\text{F}$	120±24Hz	0.5±0.1Vrms																					
8	Dissipation Factor (D.F.)		B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max. *Table 1 <table><tr><td>GRM155 B3/R6 1A 124 to 224</td></tr><tr><td>GRM185 B3/R6 1A 105</td></tr><tr><td>GRM188 B3/R6 1C/1A 225</td></tr><tr><td>GRM219 B3/R6 1A 475</td></tr><tr><td>GRM21B B3/R6 1C/1A 106</td></tr></table>	GRM155 B3/R6 1A 124 to 224	GRM185 B3/R6 1A 105	GRM188 B3/R6 1C/1A 225	GRM219 B3/R6 1A 475	GRM21B B3/R6 1C/1A 106	The D.F. should be measured at Reference Temperature at the frequency and voltage shown in the table. <table><tr><th>Capacitance</th><th>Frequency</th><th>Voltage</th></tr><tr><td>$C \leq 10\mu\text{F}$ (10V min.)*1</td><td>1±0.1kHz</td><td>1.0±0.2Vrms</td></tr><tr><td>$C \leq 10\mu\text{F}$ (6.3V max.)</td><td>1±0.1kHz</td><td>0.5±0.1Vrms</td></tr><tr><td>$C > 10\mu\text{F}$</td><td>120±24Hz</td><td>0.5±0.1Vrms</td></tr></table> *1 However the Voltage is 0.5+/-0.1Vrms about Table 1 items on the left side.	Capacitance	Frequency	Voltage	$C \leq 10\mu\text{F}$ (10V min.)*1	1±0.1kHz	1.0±0.2Vrms	$C \leq 10\mu\text{F}$ (6.3V max.)	1±0.1kHz	0.5±0.1Vrms	$C > 10\mu\text{F}$	120±24Hz	0.5±0.1Vrms		
GRM155 B3/R6 1A 124 to 224																							
GRM185 B3/R6 1A 105																							
GRM188 B3/R6 1C/1A 225																							
GRM219 B3/R6 1A 475																							
GRM21B B3/R6 1C/1A 106																							
Capacitance	Frequency	Voltage																					
$C \leq 10\mu\text{F}$ (10V min.)*1	1±0.1kHz	1.0±0.2Vrms																					
$C \leq 10\mu\text{F}$ (6.3V max.)	1±0.1kHz	0.5±0.1Vrms																					
$C > 10\mu\text{F}$	120±24Hz	0.5±0.1Vrms																					
9	Capacitance Temperature Characteristics	No bias	B1, B3 : Within +/-10% (-25℃ to +85℃) F1 : Within +30/-80% (-25℃ to +85℃) R6 : Within +/-15% (-55℃ to +85℃) F5 : Within +22/-82% (-30℃ to +85℃) C7 : Within +/-22% (-55℃ to +125℃) C8 : Within +/-22% (-55℃ to +105℃)	The capacitance change should be measured after 5min. at each specified temp. stage. The ranges of capacitance change compared with the Reference Temperature value over the temperature ranges shown in the table should be within the specified ranges.* In case of applying voltage, the capacitance change should be measured after 1 more min. with applying voltage in equilibration of each temp. stage. *GRM43 B1/R6 0J/1A 336/476 only : 1.0±0.2Vrms																			
		50% of the Rated Voltage	B1: Within +10/-30% F1: Within +30/-95%	<table><tr><th>Step</th><th>Temperature (°C)</th><th>Applying Voltage (V)</th></tr><tr><td>1</td><td>Reference Temperature±2</td><td rowspan="3">No bias</td></tr><tr><td>2</td><td>-55±3 (for R6, C7, C8)/ -25±3 (for B1, B3, F1) -30±3 (for F5)</td></tr><tr><td>3</td><td>Reference Temperature±2</td></tr><tr><td>4</td><td>85±3 (for B1, B3, F1, R6, F5) 125±3 (for C7)/ 105±3 (for C8)/</td><td rowspan="5">50% of the rated voltage</td></tr><tr><td>5</td><td>20±2</td></tr><tr><td>6</td><td>-25±3 (for B1, F1)</td></tr><tr><td>7</td><td>20±2</td></tr><tr><td>8</td><td>85±3 (for B1, F1)</td></tr></table> •Initial measurement for high dielectric constant type Perform a heat treatment at 150 +0/-10℃ for one hour and then set for 48±4 hours at room temperature. Perform the initial measurement.	Step	Temperature (°C)	Applying Voltage (V)	1	Reference Temperature±2	No bias	2	-55±3 (for R6, C7, C8)/ -25±3 (for B1, B3, F1) -30±3 (for F5)	3	Reference Temperature±2	4	85±3 (for B1, B3, F1, R6, F5) 125±3 (for C7)/ 105±3 (for C8)/	50% of the rated voltage	5	20±2	6	-25±3 (for B1, F1)	7	20±2
Step	Temperature (°C)	Applying Voltage (V)																					
1	Reference Temperature±2	No bias																					
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5	20±2																						
6	-25±3 (for B1, F1)																						
7	20±2																						
8	85±3 (for B1, F1)																						

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No.	Item	Specifications	Test Method																																				
10	Adhesive Strength of Termination	<p>No removal of the terminations or other defects should occur</p> <div><p>Fig. 1a</p></div>	<p>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 1a using an eutectic solder. Then apply 10N* force in parallel with the test jig for 10+/-1sec.</p> <p>The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <p>*5N : GR□15/GRM18, 2N : GR□33</p> <table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GR□03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>GR□15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table>	Type	a	b	c	GR□03	0.3	0.9	0.3	GR□15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55	4.5	8.0	5.6
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11	Vibration	<table><tr><td>Appearance</td><td>No defects or abnormalities</td></tr><tr><td>Capacitance</td><td>Within the specified tolerance</td></tr><tr><td>D.F.</td><td>B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max.</td></tr></table>	Appearance	No defects or abnormalities	Capacitance	Within the specified tolerance	D.F.	B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max.	<p>Solder the capacitor on the test jig (glass epoxy board) in the same manner and under the same conditions as (10).</p> <p>The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55Hz. The frequency range, from 10 to 55Hz and return to 10Hz, should be traversed in approximately 1 minute. This motion should be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).</p>																														
Appearance	No defects or abnormalities																																						
Capacitance	Within the specified tolerance																																						
D.F.	B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max.																																						
12	Deflection	<p>No cracking or marking defects should occur</p> <div><p>Fig.3a</p></div>	<p>Solder the capacitor on the test jig (glass epoxy board) shown in Fig. 2a using an eutectic solder. Then apply a force in the direction shown in Fig. 3a for 5+/-1 sec. The soldering should be done either with an iron or using the reflow method and should be conducted with care so that the soldering is uniform and free of defects such as heat shock.</p> <div><p>Fig. 2a</p><p>t : 1.6mm</p><p>(GR□03, GR□15 : t : 0.8mm)</p><table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>GR□03</td><td>0.3</td><td>0.9</td><td>0.3</td></tr><tr><td>GR□15</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>GRM18</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>GRM21</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>GRM31</td><td>2.2</td><td>5.0</td><td>2.0</td></tr><tr><td>GRM32</td><td>2.2</td><td>5.0</td><td>2.9</td></tr><tr><td>GRM43</td><td>3.5</td><td>7.0</td><td>3.7</td></tr><tr><td>GRM55</td><td>4.5</td><td>8.0</td><td>5.6</td></tr></table><p>(in mm)</p></div>	Type	a	b	c	GR□03	0.3	0.9	0.3	GR□15	0.4	1.5	0.5	GRM18	1.0	3.0	1.2	GRM21	1.2	4.0	1.65	GRM31	2.2	5.0	2.0	GRM32	2.2	5.0	2.9	GRM43	3.5	7.0	3.7	GRM55	4.5	8.0	5.6
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GRM55	4.5	8.0	5.6																																				
13	Solderability of Termination	<p>75% of the terminations is to be soldered evenly and continuously</p>	<p>Immerse the capacitor in a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25% rosin in weight proportion) .</p> <p>Preheat at 80 to 120°C for 10 to 30 seconds.</p> <p>After preheating, immerse in an eutectic solder solution for 2+/-0.5 seconds at 230+/-5°C.</p>																																				

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No.	Item	Specifications	Test Method
14	Resistance to Soldering Heat	Appearance	No defects or abnormalities
		Capacitance Change	B1, B3, R6, C7, C8 : Within $\pm 7.5\%$ F1, F5 : Within $\pm 20\%$
		Q/D.F.	B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max.
		I.R.	More than $50\Omega \cdot F$
		Dielectric Strength	No defects
15	Temperature Sudden Change	Appearance	No defects or abnormalities
		Capacitance Change	B1, B3, R6, C7, C8 : Within $\pm 7.5\%$ F1, F5 : Within $\pm 20\%$
		D.F.	B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.2 max.
		I.R.	More than $50\Omega \cdot F$
		Dielectric Strength	No defects
16	High Temperature High Humidity (Steady)	Appearance	No defects or abnormalities
		Capacitance Change	B1, B3, R6, C7, C8 : Within $\pm 12.5\%$ F1, F5 : Within $\pm 30\%$
		D.F.	B1, B3, R6, C7, C8 : 0.2 max. F1, F5 : 0.4 max.
		I.R.	More than $12.5\Omega \cdot F$
17	Durability	Appearance	No defects or abnormalities
		Capacitance Change	B1, B3, R6, C7, C8 : Within $\pm 12.5\%$ F1, F5 : Within $\pm 30\%$
		D.F.	B1, B3, R6, C7, C8 : 0.1 max. F1, F5 : 0.4 max.
		I.R.	More than $25\Omega \cdot F$

Preheat the capacitor at 120 to 150°C for 1 minute.
Immerse the capacitor in an eutectic solder solution at 270+/-5°C for 10+/-0.5 seconds. Set at room temperature for 24+/-2 hours (temperature compensating type) or 48+/-4 hours (high dielectric constant type), then measure.

•Initial measurement for high dielectric constant type
Perform a heat treatment at 150+0/-10°C for one hour and then set at room temperature for 48+/-4 hours.
Perform the initial measurement.

*Preheating for GRM32/43/55

Step	Temperature	Time
1	100°C to 120°C	1 min.
2	170°C to 200°C	1 min.

Fix the capacitor to the supporting jig in the same manner and under the same conditions as (10).
Perform the five cycles according to the four heat treatments shown in the following table.
Set for 24+/-2 hours (temperature compensating type) or 48+/-4 hours (high dielectric constant type) at room temperature, then measure.

Step	1	2	3	4
Temp. (°C)	Min. Operating Temp. +0/-3	Room Temp.	Max. Operating Temp. +3/-0	Room Temp.
Time (min.)	30±3	2 to 3	30±3	2 to 3

•Initial measurement for high dielectric constant type
Perform a heat treatment at 150+0/-10°C for one hour and then set at room temperature for 48+/-4 hours.
Perform the initial measurement.

Apply the rated voltage at 40+/-2°C and 90 to 95% humidity for 500+/-12 hours. The charge/discharge current is less than 50mA.

•Initial measurement
Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 48+/-4 hours at room temperature. Perform the initial measurement.

•Measurement after test
Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 48+/-4 hours at room temperature, then measure.

Apply 150% of the rated voltage for 1000+/-12 hours at the maximum operating temperature +/-3°C. Let sit for 48+/-4 hours at room temperature, then measure.
The charge/ discharge current is less than 50mA.

•Initial measurement
Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 48+/-4 hours at room temperature. Perform the initial measurement.

•Measurement after test
Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 48+/-4 hours at room temperature, then measure.